

Experimental Study on the Effect of Cloud on Solar Photovoltaic Panel in Jaipur (Rajasthan)

Shubham Khandelwal¹, Hari Kumar Singh², Dr. P. B. L. Chaurasia³

M. Tech (Dual Degree) Electrical +Energy Engineering Suresh Gyan Vihar University Jaipur (302017), Rajasthan (India)

Associate Professor, Department of Mechanical Engineering, Suresh Gyan Vihar University Jaipur, Rajasthan (India)

Centre of Excellence, Solar Energy Research & Utilization, Suresh Gyan Vihar University, Jaipur (302017), Rajasthan, India

Abstract: In this research paper we have discussed about the effect of cloud condition on the performance of solar photovoltaic panel. In cloud condition, there is the reduction of the solar radiation because cloud interrupts the path of beam or direct radiation, and as a result, only diffused radiation falls on the solar PV panel. This diffused radiation has lesser value of useful radiation and due to this power production will be reduced by significant value. In our experiment, reduction in power was 75.38% and short circuit current 86.36%.

Keywords: diffused radiation, solar PV panel, solar power meter, power control unit, full experimental setup.

1. Introduction

In our experiment the effect of cloud condition is discussed. The experiment is conducted in outdoor condition. The working of solar p-v panel is totally dependent on the solar radiation falling on it, cloud condition reduces the radiation. In normal condition, the radiation which is falling on the panel is global radiation. Global radiation has two components; one is beam radiation and second is diffused radiation. The beam radiation is direct radiation and it is the major part of radiation which is used to generate the electricity. In cloud condition, a shadow effect is created which reduces the radiation. In our experiment we obtained the data of short circuit current, power and open circuit voltage at various solar radiations and that data was compared with the data obtained at the highest radiation.

Electrical specification of equipments used in the experiment-

Specification of solar PV module	Rating
V_{oc} (open circuit voltage)	21.90V
I_{sc} (short circuit current)	2.45Amps
Rated current	2.30Amps
Rated voltage	17.40Volts
Maximum power point(MPP)	40 Watt
Temperature of module	25°C
Area	0.2m ²
Material of PV panel	Polycrystalline

1.1 Experimental Working

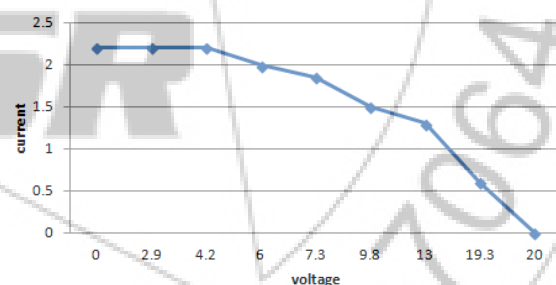
In the experiment, solar photovoltaic panel were used in the outdoor and this experiment has done in the month of May, August and September, when the radiation is maximum at around 12 O clocks and panel were placed at 0° with the horizontal.

2. Experimental Set Used

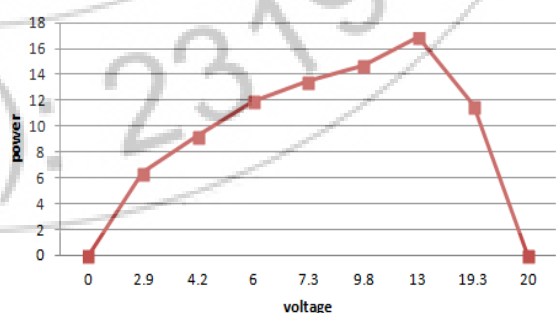
- Power control unit- in the power control unit has different measuring equipments like, ammeter, voltmeter, thermometer and all other equipments.
- Solar panel.
- Solar radiation meter.

On clear day there is no cloud condition, so there no shadow or no reduction in radiation. And global radiation measured is 1225 W/m²

current-voltage characteristic

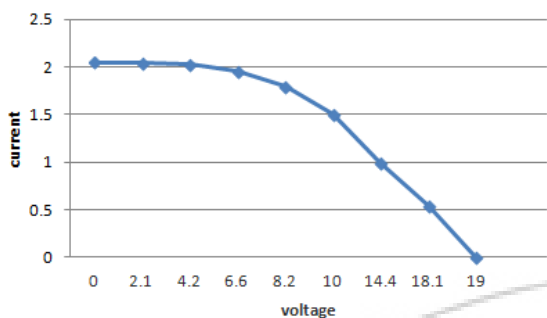


Power-voltage characteristic

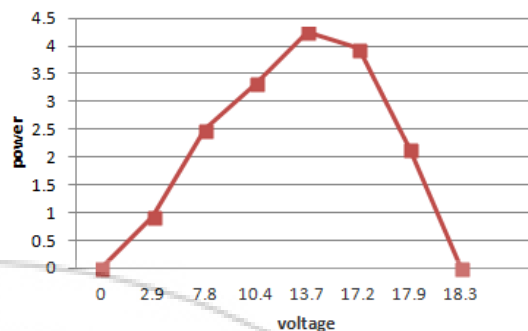


When the radiation is 1150 W/m²

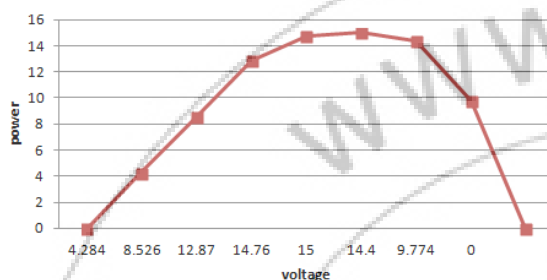
current-voltage characteristic



Power-voltage characteristic

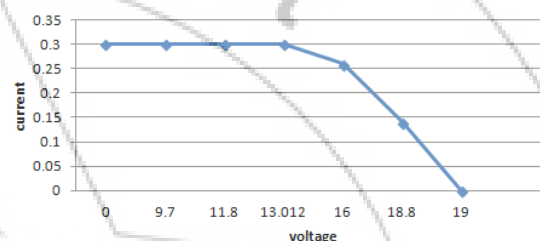


Power-voltage characteristic



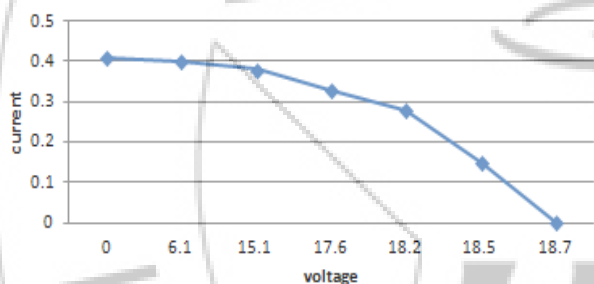
When the radiation is 156 W/m^2

current-voltage characteristic

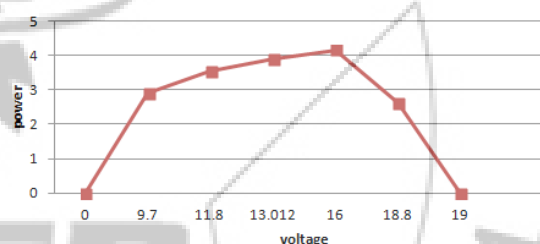


When there is more cloud present so reduction in radiation can be seen and radiation measured is 290 W/m^2 .

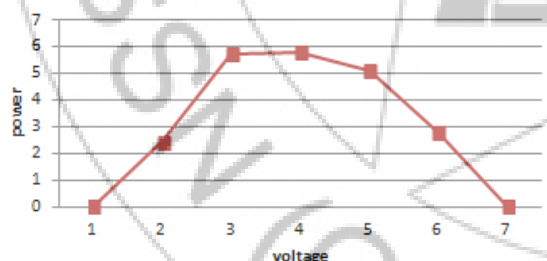
current-voltage characteristic



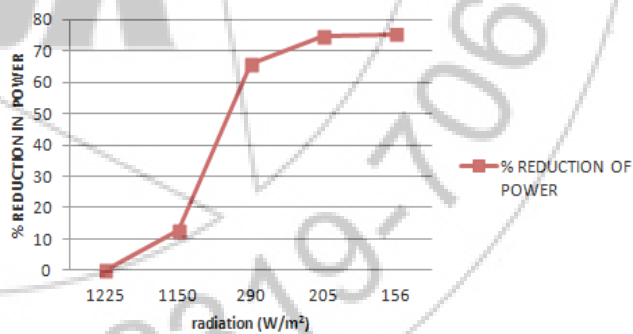
Power-voltage characteristic



Power-voltage characteristic

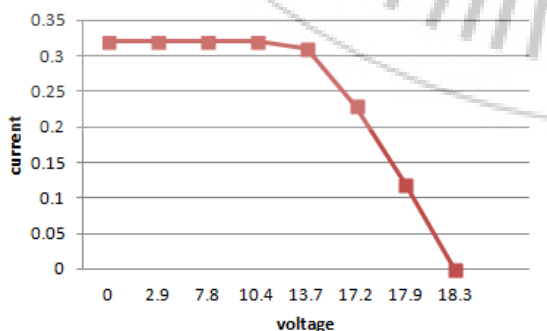


% REDUCTION IN POWER

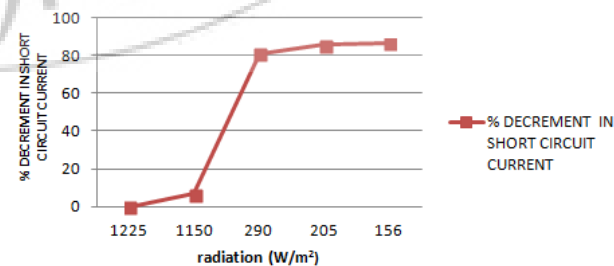


When the radiation is 205 W/m^2

current-voltage characteristic



% DECREMENT IN SHORT CIRCUIT CURRENT



3. Result and Conclusion

In our experimental study, we have seen the effect of cloud on the working of solar PV module, the data obtained in the experiment clearly showing data short circuit current is reduced to 86.36% and power is reduced to 75.38% respectively.

4. Future Scope and Recommendation

It is very clear from the study that, if we have to install a power plant on large scale then the climate and weather condition of that region or location must be taken into consideration so that maximum output can be taken from it.

5. Acknowledgement

I would like to thanks my friend Pawan Kumar Tiwari, Pawan Kumar Pandit, Saurav Kumar, Shobhit Kumar and further, I would like to thanks my parents.

References

- [1] Hussein A Kazem, Tamer Khatib, K. Sopian, Frank Buttinger, Wilfried Elmenreich, Ahmed Said Albusaidi "Effect of Dust Deposition on the Performance of Multi-Crystalline Photovoltaic Modules Based on Experimental Measurement" Received: published in 2013 in INTERNATIONAL JOURNAL of RENEWABLE ENERGY RESEARCH.
- [2] Shaharin A. Sulaiman, Haizatul H. Hussain, Nik Siti H. Nik Leh, and Mohd S. I. Razali "Effects of Dust on the Performance of PV Panels" in World Academy of Science, Engineering and Technology in 2011.
- [3] Solar Power Information (2009, 8 April 2011). Solar Panels. Available: www.solarpower2day.net/solar-panels/.
- [4] H. P. Garg, "Effect of dirt on transparent covers in flat-plate solar energy collectors," Solar Energy, vol. 15, pp. 299-302, 1973.
- [5] J. Zorrilla-Casanova*1, M. Piliouginel, J. Carretero1, P. Bernaola1, P. Carpenal, L. Mora-López2, M. Sidrach-de-Cardonal "Analysis of dust losses in photovoltaic modules" in world renewable energy congress 2011- Sweden.
- [6] Rajesh Agnihotri1*, Sumit K. Mishra1,2, Pawan Yadav1, Sukhvir Singh1, Rashmi1, M.V.S.N. Prasad1, C. Sharma1, Bhuwan Chandra Aryal "Bulk Level to Individual Particle Level Chemical Composition of Atmospheric Dust Aerosols (PM5) over a Semi-Arid Urban Zone of Western India (Rajasthan)" Aerosol and Air Quality Research, x: 1-14, xxxx Copyright © Taiwan Association for Aerosol Research ISSN: 1680-8584 print / 2071-1409 online doi: 10.4209/aaqr.2013.08.0270.
- [7] Reinhart Appels^a, Buvaneshwari Lefevre^a, Bert Herteleer^a, Hans Goverde^{a,b}, Alexander Beertena^a, Robin Paesena^a, Klaas De Medts^a, Johan Driesena, Jef Poortmans^b "Effect of soiling on photovoltaic modules" published in 2013.
- [8] P.K. Singh*, Ravi Kumar, P.N. Vinod, B.C. Chakravarty, S.N. Singh "Effect of spatial variation of

incident radiation on spectral response of a large area silicon solar cell and the cell parameters determined from it" published in 2003, Solar Energy Materials & Solar Cells 80 (2003) www.elsevier.com/locate/solmate.

- [9] Ahmed Elsayed Ghitas "studying on spectral variations intensity on the incident solar radiation on si solar cell performance" National research institute of astronomy and geophysics, published in 2013.
- [10] W.de.Soto, S.A. Klein*, W.A. Beckman "improvement and validation of a model for photovoltaic array performance," published in, www.elsevier.com/locate/solener.
- [11] Ecosense insight solar "solar photovoltaic training and research kit experiment manual", info@ecosenseworld.com, www.ecosenseworld.com.

Author Profile



Shubham Khandelwal born in Rajasthan (India) in 1992 received the B Tech degree in 2013 from Electrical Engineering and pursuing M Tech Energy Engineering from Suresh Gyan Vihar University, jaipur, Rajasthan, India. During 2013-14 the experimental work has been done the effect of cloud on solar PV panel in the solar lab provided by the Suresh Gyan Vihar University